Two Small Orthocladinae (Chironomidae, Diptera) from the Western Cape Province, South Africa

by

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ABSTRACT

All life stages of two small Orthocladiinae from mountain streams and rivers in the Western Cape Province are described. *Notocladius capicola*, new genus and species, is very abundant and is able to feed on very small particles scraped off the substratum and must play an important part in the food chain; *Parakiefferiella biloba* Freeman, here described in detail for the first time, is far less abundant and its gut is packed with diatom frustules.

INTRODUCTION

The Chironomidae form an important part of freshwater communities, with many of their larvae feeding on algae and making available the energy from primary production to larger invertebrates and vertebrates. Workers in the field of freshwater research also find chironomid communities useful as indicators of ecological changes taking place in the environment; this makes their correct identification, specially of their larvae and pupae very important. This paper deals with all life stages of two small members of the sub-family Orthocladiinae, one is very common in mountain streams and rivers and its larva feeds on very small particles scraped from the rocks. Nevertheless, the adult has not been seen before and shows such peculiar features that a new genus and species has had to be created for it.

METHODS

Adults were caught by sweeping vegetation near streams and rivers; larvae and pupae were caught in nets with fine mesh (< 0.5 mm). All specimens were preserved in 70% or 80% alcohol and mounted in Canada Balsam dissolved in cellosolve. Measurements were made with an eyepiece micrometer and all drawings with a drawing tube on the microscope.

Sources of generic definitions for *Parakiefferiella* are given in the text. Morphological terminology is from Sæther (1980).

Abbreviations used in this paper are:

AR = antennal ratio. Ratio of length of apical flagellomere to combined length of basal flagellomeres.

LR = leg ratio. Ratio of length of tarsomere 1 to length of tibia.

SV = 'Schenkel-Schiene-Verhältnis'. Ratio of femur plus tibiae to tarsomere 1.

BV = 'Beinverhältnisse'. Combined length of femur, tibia and tarsomere 1 divided by length of tarsomeres 2 to 5.

DESCRIPTIONS

Notocladius Gen, nov.

Definition

ADULT MALE. Small midge with wing length of about 1.00 mm. Head: antenna with 10 flagellomeres, groove beginning at antennomere 3, apex without large subapical seta. No frontal tubercles. Eye hairy, without dorsomesal extension; one outer vertical seta. Tentorium widest at basal half; clypeus normal, palp segment 3 with at least one subterminal sensillum.Thorax: antepronotal lobes separated by a shallow notch, no scutal tubercle; acrostichals absent; dorsocentrals erect, uniserial; 3 prealars; 2 scutellars. Wing: membrane without sètae, very transparent, punctuation very fine; no anal lobe; R1 and R_{2+3}, later joined by R_{4+5}, fusing with costa to form clavus which terminates before half the wing length; costa not extended; weak false vein from RM to wing tip; Cu straight; wing veins without setae except costa; squama bare. Legs: spurs and comb normal, no pseudospurs; no sensilla chaetica on tarsomere 1 of mid and hind leg; tarsomere 4 short and slightly cordiform; no pulvillae. Hypopygium: no anal point, virga absent; no superior or inferior volsellae; gonostylus simple without crista dorsalis.

ADULT FEMALE. Wing length about 1.1 mm. Head: antenna with 5 flagellomeres, apex without large subapical seta. Eye similar to male, 1 outer vertical seta, no frontal tubercles. Palp similar to male except that segments 2 and 3 are fused. Thorax similar to male. Wings similar to male but clavus comparably longer extending more than halfway to wing tip. Legs similar to male but sensilla chaetica present on tarsomere 1 of mid and hind leg. Genitalia: gonopophysis VIII simple, not divided into ventro-lateral and dorso-medial lobes; gonocoxapodeme of VIII and coxosternapodeme of IX prominent; gonocoxite IX closely applied to body with one seta; postgenital plate of X triangular. Seminal capsules with short necks, ducts convoluted with common opening. Cerci small.

PUPA. Small (1.4 - 1.6 mm). Cephalothorax: setae - frontal setae absent, 2 antepronotals, 3 small precorneals, 2 widely spaced dorsocentrals. No thoracic horn. Abdomen: posterior single row of small hooks on tergites III - V and on sternites V - VII. Shagreen of small posteriorly pointing spines, none on tergite I, sparse on tergites II - IV, denser on V - VIII forming broad anterior bands; segmental setae small, anal lobe with 3 short macrosetae and no fringe, small lateral denticles present.

LARVA. Small, up to 1.5 mm. long. Antenna: 4 segmented, blade extending to apex of segment 2, Lauterborn organs small, style small. Labrum: seta SI bifid, remaining setae simple; no labial lamella; pecten epipharyngis of 3 subequal scales; some chaetulae lateralis enlarged and filmy with ciliary fringe; premandible with 2 teeth, one thin and pointed, the other broad and blunt; no brush. Mandible: apical tooth with 4 inner teeth, seta subdentalis small, seta interna small but with many branches. Mentum: 1 median and 6 pairs of lateral teeth, ventromental plate distinct but small, no beard. Maxilla: palpiger normal, chaetulae small, no pecten galearis, lacinal chaetae large, antaxial seta present. Body: parapods normal; procercus about as high as wide with strong setae.

***Notocladius capicola* spec. nov.**

This species is based on a large number of males and females, numerous pupae, some with pharate males, and numerous larvae caught with the pupae and assumed to belong to this species.

ADULT MALE (N=5 mounted and many unmounted)

As per generic definition.

Body length. up to 1.2 mm.

Wing length. 1.0 mm.

Colour. Head and antennae brown; thorax: background creamy yellow, scutal stripes separate and dark brown, setal pits large and light, preepisternum dark brown, legs brown, wings very transparent and colourless; abdomen: tergites I-V dark brown, VI and VII with a narrow brown anterior stripe and the rest yellowish, VIII and hypopygium brown.

Head (Fig. 1). AR 0.25, 10 flagellomeres, apical flagellomere somewhat swollen (Fig. 2), terminal setae small and colourless, mostly sensilla chaetica; eyes hairy; clypeus not swollen; palp segments 16, 12, 28, 62, 102, µm; 1 subapical sensilla on segment 3.

Thorax. Setation: antepronotals 0-1, dorsocentrals 9-11, prealars 3, 1 scutellar per side.

Wings (Fig 3). Anal lobe absent, squama bare, length of clavus/winglength (including brachiolum) 0.3. A false vein from clavus almost to wing tip and a second between this and M_{1+2}. Setation: brachiolum 1, no setae on R or M veins.

Legs. Tarsomere 4 short and slightly cordiform (Fig 4). LR fore 0.85, mid 0.63, hind 0.68; SV fore 2.5 , BV fore 4.0 . No sensilla chaetica on tarsomeres.

Hypopygium (Figs 5, 6 and 7). Anal point absent but 6 anal setae present (Fig. 5). Inferior volsella absent but with row of strong setae in the position where it normally appears in other Orthocladinae (Fig. 6). Gonostylus comparatively small but with large megaseta. Fig. 7 shows the apodemes.

ADULT FEMALE (N=6 mounted, many unmounted)

As per generic definition.

Body length. 1.0 mm.

Wing length. 1.1 mm.

Colour. Similar to male but abdominal tergites uniformly brown.

Head. AR 0.4, 5 flagellomeres. Head setae: 1 outer vertical per side. Palps: segments 2 and 3 are fused but can still be distinguished, 3 has a small terminal projection, lengths 28, 25, 59, 53, 93 µm. 1 subapical sensilla on 3.

Thorax. No scutal tubercle. Setation: lateral antepronotals nil, dorsocentrals 10, posterior prealars 3, scutellars 2 per side.

Wings. Similar to male but clavus longer, length of clavus/wing length (including brachiolum) 0.48, extending more than half-way to wing tip.

Legs. General structure similar to male including tarsomeres 4. LR fore 0.7, mid 0.6, hind 0.7. Sensilla chaetica on tarsomere 1, midleg 12, hindleg 7.

Genitalia (Figs 8-10). Gonocoxite not divided into ventrolateral and dorsomedial lobes, but apodeme lobe appears to be present (Fig. 8A); gonocoxapodeme (8B) is dark and slightly curved; coxosternapodeme of IX (8C) dark, prominent and strongly bent; gonocoxite IX closely applied to body with one seta (Figs 8 and 9); coxae small; tergite X with 2 low posterior protruberances each with a long seta (Fig.9). Seminal capsules oval, light brown, with short necks, ducts convoluted with common opening (Fig.10).

PUPA (numerous specimens mounted some with pharate males or females)

As per generic description.

Colour. Greenish in life but occurs in small tent-like light grey tube or cocoon. Exuviae are very light and transparent.

Cephalothorax. Dorsal surface covered with small tubercles; no thoracic horn. Setation: no frontal setae, 2 antepronotals, 3 small subequal precorneals, two widely spaced dorsocentrals probably representing one member each of the D1,2 and D3,4 pairs.

Abdomen (Figs 11 and 12). Fine shagreen on tergites II-IV and denser, broad anterior bands on V-VIII, no shagreen in conjunctives. Setation as in Fig. 11. Posterior hook rows on tergites III to V and sternites V to VIII. Anal lobe with 3 short macrosetae subterminal and 2 terminal setae, no fringe (Fig. 12).

LARVA (numerous larvae mounted and unmounted)

Similar to generic definition

Colour. Dark green in life with head capsule and posterior claws appearing black.

Body length. Up to 1.5 mm, but difficult to measure as preserved larvae are invariably curved. Head capsule. 300-312 µm.

Antenna (Fig. 13). AR 0.6, ring organ in basal third of segment 1, blade reaching nearly to base of segment 3, Lauterborn organs and style small.

Labrum (Fig. 14). SI bifid but branches usually closely applied making this difficult to see, pecten epipharynx with 3 subequal teeth, first pair of chaetulae lateralis scalelike, but others large and filmy, fringed with ciliary projections forming part of a filtering apparatus with the modified prementohypopharyngeal complex. Premandible (Fig. 15) with one thin pointed tooth and one broad blunt tooth, without brush.

Mandible (Fig. 16).Teeth dark brown, seta subdentalis pointed, seta interna small with many fine branches.

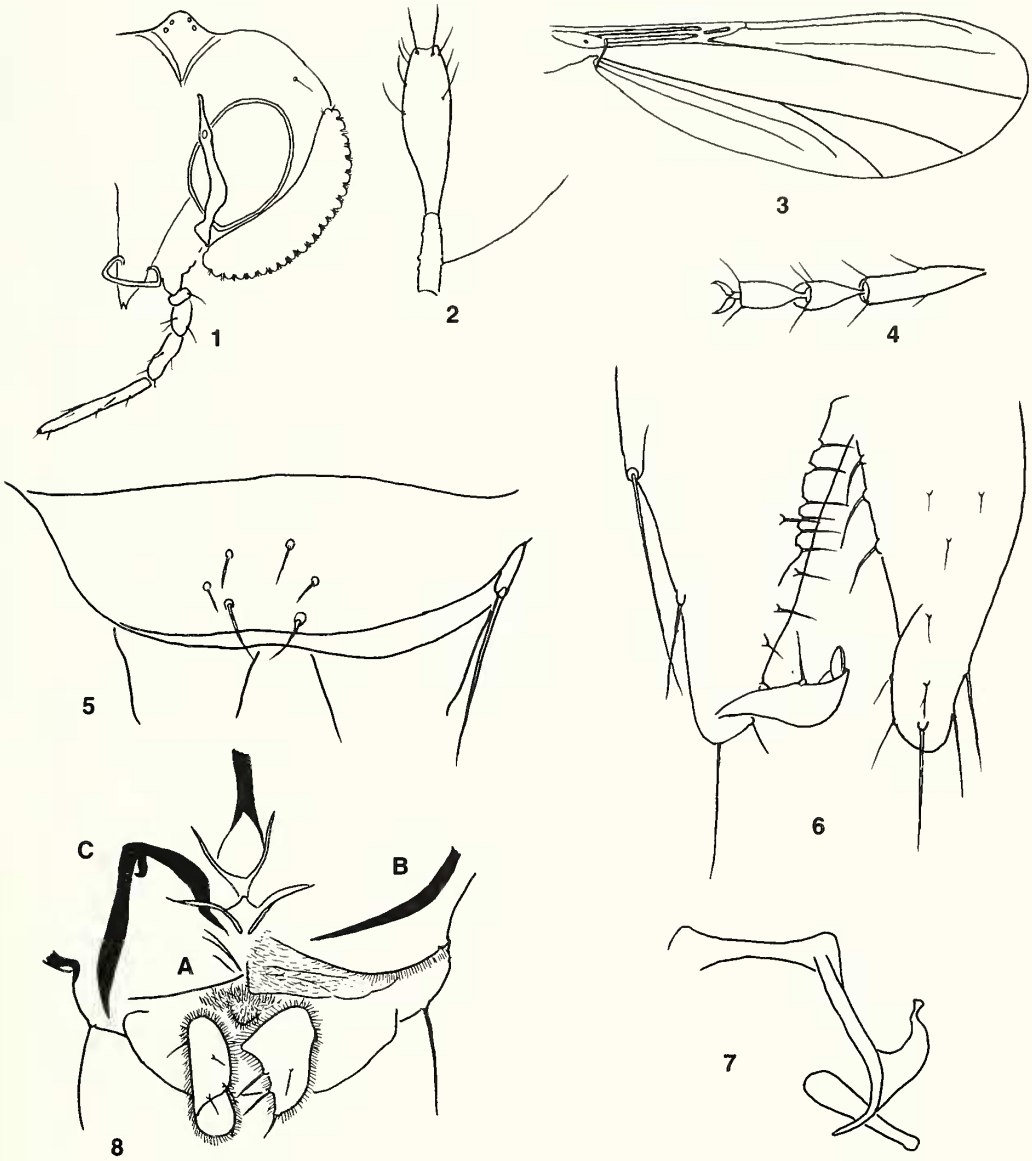
Mentum (Fig. 17). Somewhat elongate, teeth brown, median tooth slightly shorter than first pair of lateral teeth in unworn specimen, ventromental plate distinct but narrow.

Maxilla (Fig 18). As in generic definition.

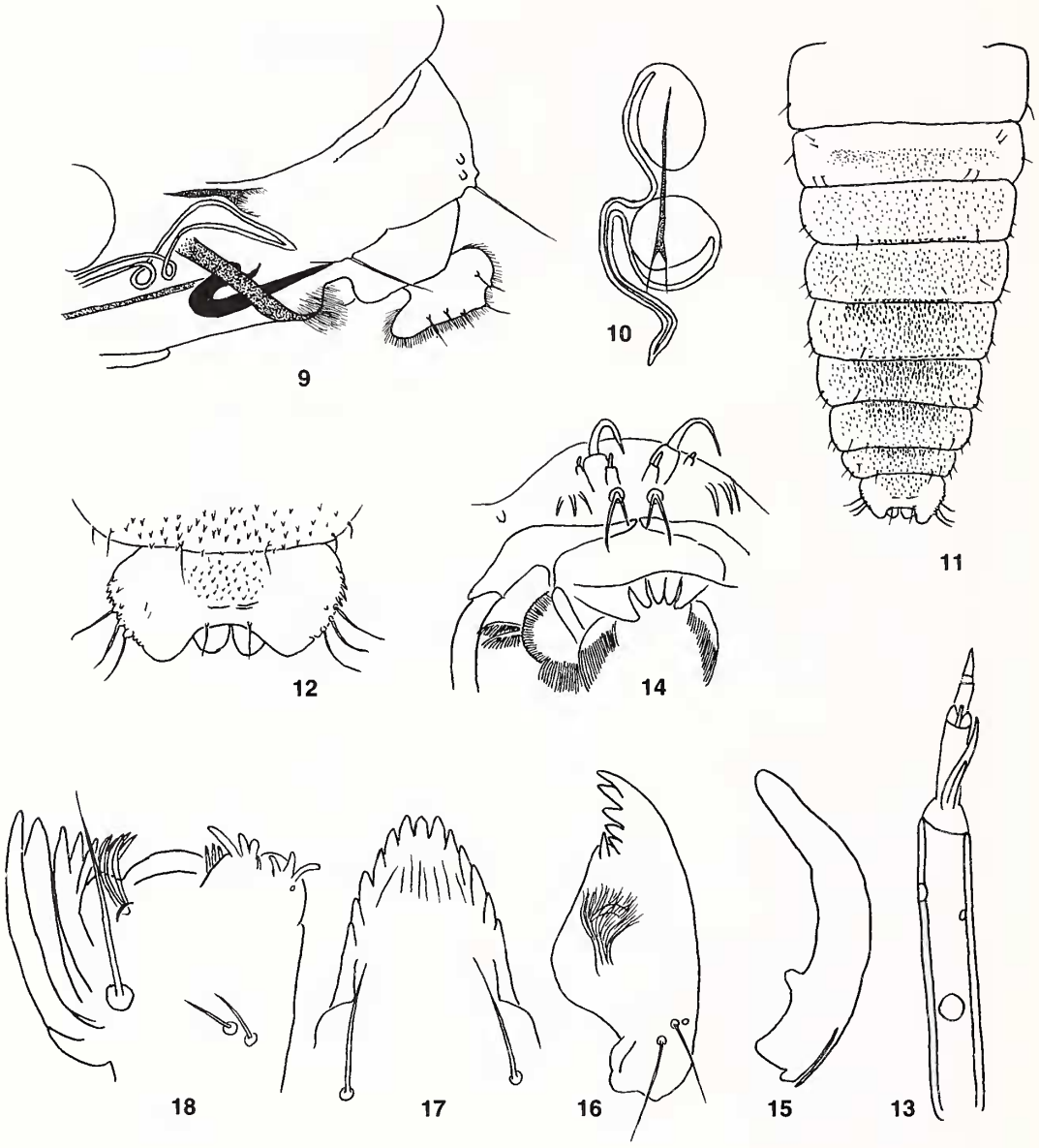
Body. Claws of anterior parapod serrated towards tip, postparapod claws simple, small and dark brown, setae of procercus dark brown, only one pair of small setae in anal region. Body setae appear to be absent.

SPECIMENS EXAMINED. Adults: numerous males and females were netted in the evening or caught in light traps beside the Elands River (33°44´S, 19°06´S), 27.iv.1996, and netted drowned in the Elands River and in the mountain zone of the Riviersonderend (34°03´S, 19°04´E) during ecological work in 1994-95. Numerous pupae and larvae were available from R.Tharme's ecological work in the Elandsrivers, the Dutoitskloof (33°56´S, 19°10´E), the Molenaars (33°43´S, 19°10´E), in the Dutoitskloof Mountains and the mountain zone of the Riviersonderend during 1994-95, all in the Western Cape Province.

Holotype and paratype males, paratype female and pupal and larval material, all mounted on slides, deposited in the Albany Museum, Grahamstown, Eastern Cape Province. COMMENTS. This genus resembles species in the *Corynoneura*-group by the presence of a clavus in the wings of both sexes. According to Sæther and Kristoffersen (1996) there is a distinct sexual dimorphism in the formation of the clavus in the *Corynoneura*-group. In males R_{4+5} plays no part in



Figs 1- 8. *Notocladius capicola.* Adult male: 1. head; 2. antenna, apical flagellomere; 3. wing; 4. tarsomeres 3, 4, 5; 5. anal segment; 6. hypopygium; 7. apodemes. Adult female. 8. genitalia, ventral, A apodeme lobe, B gonocoxapodeme, C coxosternapodeme.



Figs 9 - 18. *Notocladius capicola.* Adult female: 9. genitalia, lateral; 10. seminal capsules and ducts. Pupa: 11. abdomen; 12. anal lobe. Larva: 13. antenna; 14. labrum; 15. premandible; 16. mandible; 17. mentum; 18. maxilla.

its formation but in certain females the base of this combined vein is thickened and in some it is fused to the clavus, as in both sexes of *Notocladius*. These authors consider that the "false vein" arising from the thickened base of R_{4+5} is in reality the extension of this vein and that the additional "false vein" between R_{4+5} and M may represent a vestige of M_1. Their interpretation can be applied to the wing of *Notocladius* but it is not suggested that this genus falls into the *Corynoneura*-group. This type of wing structure appears to be associated with small body size.

Neglecting wing structure, *Notocladius* keys to somewhere near *Lopescladius* in the key of Cranston *et al.* (1989). The pupae do not fit in anywhere in the key in Coffman *et al.* (1986) but the larvae key into the *Orthocladius-Cricotopus* group in Cranston *et al.* (1983) because of the bifid seta S I and the structure of the mentum. Of course, for practical reasons, keys are based on apomorphic characters which have been developed as a result of ecological specialisation.

ECOLOGY. The tiny larvae and pupae often occur in large numbers on the surface of stones and rocks in the fast current in second or third order mountain streams and rivers in the Western Cape Province. The dark green bodies and almost black head capsules of the free-living larvae make their comma-like appearance most distinctive. They appear to be scrapers but their gut contains very few diatoms, mostly amorphous matter; the filter-like mechanism of their mouth parts should help to gather very small particles scraped off the surface, making them an important part of the food chain. On pupation the larvae make tent-like cases mostly of silk-like fibres incorporating very little detritus, one end is broader than the other and open and presumably faces downstream; no larval remains were found in any of the large number of pupal cases examined.

Adult males swarm at dusk which proved to be a good time to net both males and females; both were also caught in light traps.

So far *N. capicola* has only been found in the soft acid waters of the Table Mountain Sandstone system of the Western Cape Province.

***Parakiefferiella biloba* Freeman**

Eukiefferiella (Parakiefferiella) biloba, Freeman 1953
Nanocladius biloba, Freeman 1956
Parakiefferiella biloba, Freeman and Cranston 1980

The material studied consists of males, females, pupae, one with mature pharate female, and larvae. Most specimens came from a small mountain stream on the Cape Peninsula which was reduced to a trickle during the dry summer season. The fauna of the stream was very depauperate with very few orthoclad species (including only one species of *Parakiefferiella, P. biloba*) being present. It was therefore considered safe to assume that the only larvae of this genus present in a large numbers of samples must be of this species.

Freeman (1953, 1956) describes the male but a more detailed description is given here.

ADULT MALE (N = 5 mounted, numerous species unmounted)

Differs somewhat from the generic definition in Cranston *et al.* (1989).

Body length. 2.00 mm.

Wing length. 1.00 mm.

Colour. Unmounted specimens head, antennae and palps light brown; thorax; scutal stripes and pre-episternum light brown, background and legs yellowish, wings very light brown; abdomen and

hypopygium fairly uniform light brown.

Head. AR 0.17,12 flagellomeres, 1-3 wider than the rest except for 11 and 12 which form a club, which appears bilobed because of its irregular shape and the prominent groove (Fig. 19), numerous sensilla chaetica on apical flagellomere; no frontal tubercles; eyes bare, small with no dorsal extension, tentorium (Fig. 20) wider ventrally. Head setation: 3 postorbital setae; palp segments 16, 22, 34, 47, 59 µm, 2 subapical sensillae on segment 3, no segment with apical extension.

Thorax. Scutal tuft of microtrichia, diagnostic for the genus, is weak and lies in a small pale patch, but also includes two very small acrostichal setae. Setation: lateral antepronotals absent, dorsocentrals 9, posterior pre-alars 3, scutellars 2 per side.

Wings (Fig. 21). Similar to Freeman's figures but he does not show that the retracted costa and R veins are thickened; the costa is produced beyond R_{4+5}; R_{2+3} runs close to R_{4+5} and does not end clearly in the costa. Setation: R 1, R_1 nil, R_{4+5} 1 at tip. There is no anal lobe and one squamal setae (Freeman's specimens had 0 - 2 squamal setae).

Legs. All tarsomeres cylindrical. LR fore 0.9, mid 0.4, hind 0.5. SV fore 2.6, BV fore 2.8. No sensilla chaetica on tarsomeres 1 of midleg and hindleg.

Hypopygium (Figs 22, 23 and 24). Similar to Freeman's figures but he has not shown the virga that is also found in most species of this genus; the small anal point has a large seta on either side (Fig. 22), the inferior volsella is digitiform; the gonostylus (Fig. 23) is not as curved as that illustrated by Freeman but its shape is largely a matter of aspect. The apodemes are shown in Fig. 24.

ADULT FEMALE (N = 5 mounted, many unmounted)

Similar to generic definition in Sæther (1977), except for structure of gonopophysis VIII.

Body length. 1.3 mm.

Wing length. 1 mm.

Colour. Similar to male.

Head. AR 0.5, 5 flagellomeres, last somewhat swollen; no frontal tubercles; eyes similar to male; setation 2 outer verticals, 2 postorbitals. Palp segments 16, 22, 34, 47, 62 µm; 2 subapical sensillae on segment 3.

Thorax. Scutal patch smaller than that of the male but also with 2 small acrostichal bristles; setation: lateral antepronotals nil, dorsocentrals 8, posterior pre-alars 3, scutellars 1 or 2 per side.

Wings. Similar to male; setation: brachiolum 1, R 5, R_1 1, R_{4+5} 2, Squama 1 or 2.

Legs. LR fore 0.7, mid 0.4, hind 0.5. No sensilla chaetica on any tarsomeres.

Genitalia (Figs 25, 26 and 27). Gonopophysis VIII divided into a small dorsomesal lobe (Fig. 25 A) and a much larger ventrolateral lobe (Fig. 25 B); the small structure below the dorsomesal lobe in the figure may be an apodeme lobe; gonocoxapodemes light in colour and joined (Fig. 25 C), coxosternapodemes light but prominent (Fig. 25 D); tergite IX with two small posterior protrusions each with one seta; gonocoxite IX welldeveloped with two long and two short setae (Figs 25 and 26), segment X normal, postgenital plate small and rounded, cerci large. Seminal capsules ovoid, brown but with a clearly demarcated light area at junction with spermathecal ducts which are long and convoluted and open close to each other (Fig. 27).

PUPA (N = 3 mounted)

Does not follow generic definition of Coffman *et al.* (1986) in all respects.

Colour. Exuviae are fairly uniform light yellow, shagreen on abdomen darker.

Cephalothorax. Dorsal surface finely pebbled with sculpturing becoming progressively finer laterally. Frontal setae long, not on tubercles (Fig. 28), 2 median antepronotals, 3 small, short subequal precorneal, 3 dorsocentrals, 1 anterior, and pair posterior; thoracic horn with a few terminal and subterminal spines (Fig. 29).

Abdomen (Fig. 30). Shagreen on tergites I-VII of small posteriorly pointing spines with larger spines forming anterior band and much larger spines forming narrow posterior band, fine, anteriorly pointing spines in conjunctives II-III to VI-VII (Fig. 31) ; no hook row on II; some short spines on sternites IV-VII. No pedes spurii A or B. Abdominal setation as in Fig. 30, no fringe of taeniate setae on any segment. Anal lobe truncated at apex, not tapering as in other species of this genus; 3 anal macrosetae.

LARVA (N = 5 mounted, many unmounted)

Similar to generic definition in Cranston *et al.* (1983) but differs in some respects

Colour. Head capsule light brown, claws very light, body yellowish when preserved.

Body length. 1.5 2.0 mm.

Head capsule length. 169 195 µm.

Antenna (Fig 32). AR 0.8; 6-segmented, segment 6 hair-like; blade reaching to base of segment 3 which is very short (1.9 µm) and completely surrounded by large Lauterborn organs, style could not be detected.

Labrum (Fig. 33). SI with 3 branches, remaining S setae simple; no labral lamella; pecten epipharynx of 3 subequal scales; premandible with 2 apical teeth (Fig. 34).

Mandible (Fig.35). Teeth brown, short apical tooth and 4 inner teeth; seta subdentalis and seta interna both present.

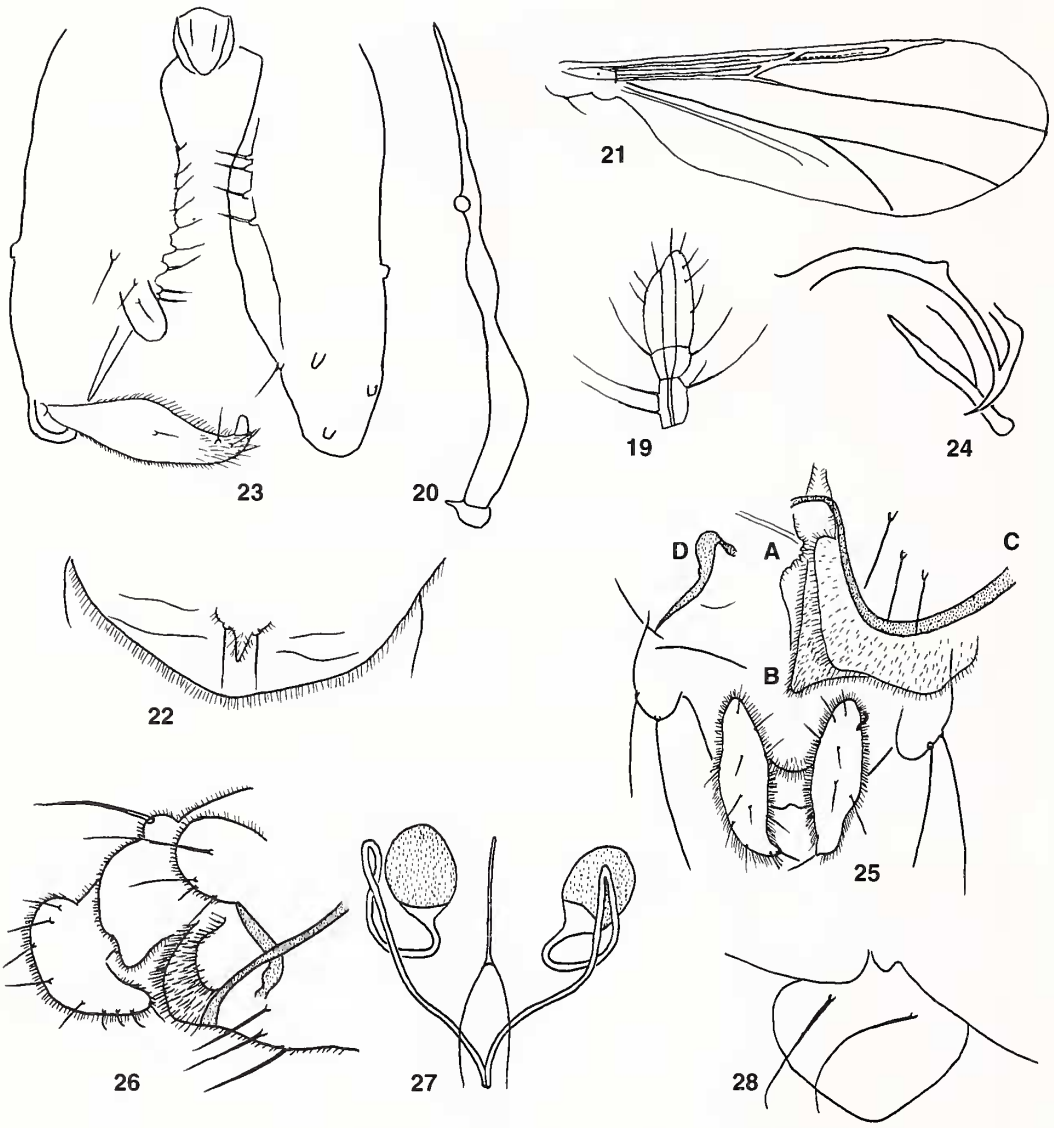
Mentum (Fig. 36, unworn specimen). Teeth brown, 2 median teeth and 5 lateral teeth, there is a sign of an additional lateral tooth adpressed to each median tooth; ventromental plate very small.

Maxilla (Fig 37). Palpiger normal with numerous small lamellae at base, mostly behind the palpiger in the figure; a pecten galearis could not be detected; the base of an antaxial seta present but no seta; seta maxillaris simple.

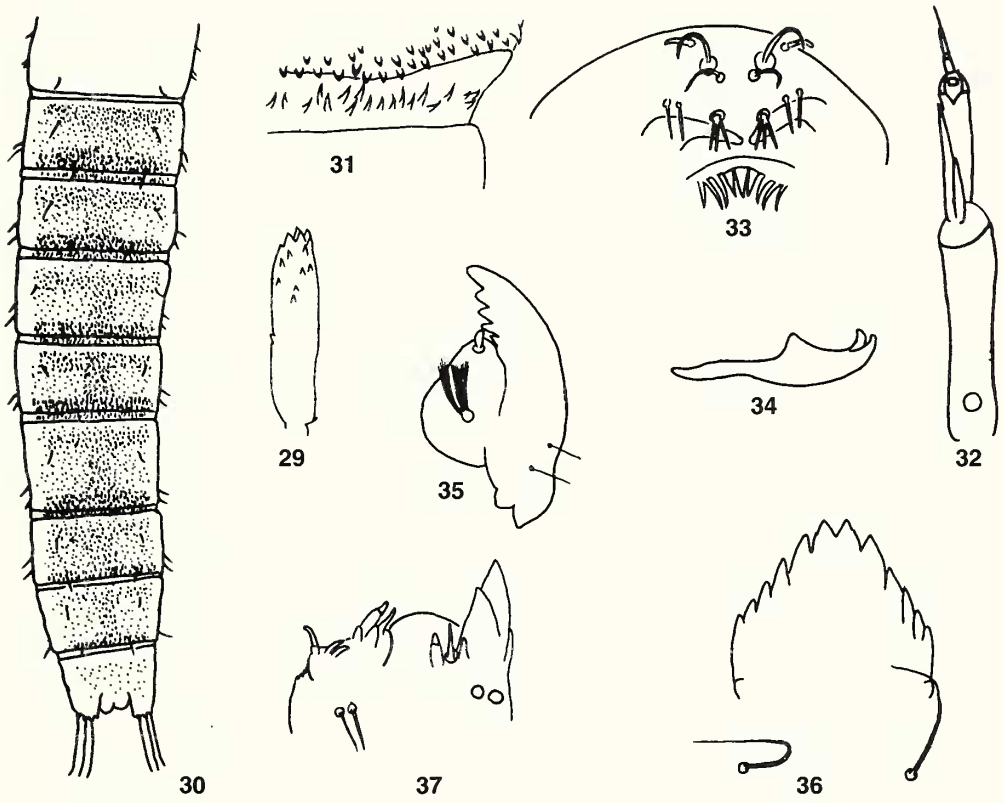
Body. Parapods normal; procercus 2x as long as wide with 8 long setae; some simple body setae up to 62 µm long; anal tubules shorter than parapod and somewhat conical in shape.

SPECIMENS EXAMINED. Adults: numerous males and females from small waterfall, tributary of Silvermine River, Cape Peninsula, 10 and 11.xi.1995, 24.ii.1995, 1.xii.1995, 9.i.1996; 1 female, Kalk Bay waterfall, Cape Peninsula, 20.xii.1994; numerous males and females, Elands River, Du Toit's Kloof (33°44´S, 19°06´E), 27.iv.1996; 1 male upper Riviersonderend (34°03´S, 19°04´E), 8.iv.1995. Pupae: small waterfall, tributary of Silvermine River 2 exuviae 24.xi.1995, 1 pupa with pharate female 1.xii.1995. Larvae: numerous from the tributary of Silvermine River at dates above.

COMMENTS. The adult male, pupa and larva all differ from the generic definitions to some extent; the male in that it has small acrostichal setae in the thoracic tuft of microsetae, the squama of the wing is not bare; the pupa in that the anal lobes are truncated at the apex and not extended into tails; the larvae in that the Lauterborn organs of the antennae are large and not small and the antennal style is absent or much reduced and not strong. There are a few other minor differences, but none seem to warrant a new genus being erected. It should be noted that neither the male nor the female adult has the apical projection on palp segments as seen in the African species discussed by Ferrington and Sæther (1995).



Figs 19- 28. *Parakiefferiella biloba.* Adult male: 19. flagellomeres 11 and 12; 20. tentorium; 21. wing; 22. anal point; 23 hypopygium; 24 apodemes. Adult female. 25. genitalia, ventral, A dorsomesal lobe, B ventrolateral lobe, C gonocoxapodeme, D coxosternapodeme; 26 genitalia, lateral; 27. seminal capsules and ducts. Pupa: 28.frontal setae.



Figs 29 - 37.*Parakiefferiella biloba.* Pupa: 29 thoracic horn; 30. abdomen; 31. conjuctive II-III. Larva. 32. antenna; 33. labrum; 34.premandible; 35. mandible; 36. mentum; 37. maxilla.

ECOLOGY. *P. biloba* is found in first or second order mountain streams and small rivers. The larvae from the small waterfall were inhabiting the moss and *Scirpus digitatus* in the water flow.

DISTRIBUTION. Cape Peninsula mountains. Western Cape Province Fold Belt Mountains and source streams of the Tugela River, Drakensberg Mountains, KwazuluNatal.

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